



DRUG RESISTANCE

Subject: Science | Current: 2010 | Grade: 9-12

Day: 1 of 2

1 Purpose

To illustrate the causes and effects of bacteria drug resistance.

2 Duration of Lesson

50 minutes

3 Additional Topics

Bacteria, Antibiotics, and Health Issues

4 Objectives

At the conclusion of this lesson, students will be able to:

- Describe the mechanism behind the spreading of drug resistance
- Identify common “breeding grounds” for bacteria
- Explain the measures to be taken to limit the spread of antibiotic resistance

5 Standards & Benchmarks

BIOLOGY

Recognize and explain how the many cells in an individual can be very different from one another, even though they are all descended from a single cell and thus have essentially identical genetic instructions. Understand that different parts of the genetic instructions are used in different types of cells and are influenced by the cell’s environment and past history.

B.1.1

Understand and describe how the maintenance of a relatively stable internal environment is required for the continuation of life and explain how changing physical, chemical

B.1.17



Describe how natural selection provides the following mechanism for evolution: Some variation inheritable characteristics exist within every species, and some of these characteristics give individuals an advantage over others in surviving and reproducing. Understand that the advantaged offspring, in turn, are more likely than others to survive and reproduce. Also understand that the proportion of individuals in the population that have advantageous characteristics will increase.

B.1.31

HEALTH & WELLNESS

Examine how public health policies and government regulations can influence health promotion and disease prevention.

HW.2.10

Indiana Department of Education. (n.d.). Indiana Standards and Resources: Sciences: Biology; Health & Wellness. Retrieved from <http://dc.doe.in.gov/Standards/AcademicStandards/StandardSearch.aspx>

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Vocabulary

----- These terms are included in the lesson plan:

- **Antibacterial** – Destructive to or inhibiting the growth of bacteria.
- **Antibiotic Resistance** - The ability of bacteria to withstand the effects of antibiotics.
- **Antiseptic** – Free from or cleaned of germs and other microorganisms.
- **Bacteria** – One-celled organisms shaped as a sphere, spiral, or rod.
- **Disinfectant** – Any chemical agent used chiefly on inanimate objects to destroy or inhibit the growth of harmful organisms.
- **Microorganisms** – small organisms such as bacteria, protozoa, fungi and algae.
- **Natural Selection** – The process in which life forms have traits that allows them to adapt to specific environmental pressures to ensure passing those traits to succeeding generations.

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Materials

- “Why Does Evolution Matter Now?” Video - <http://www.pbs.org/wgbh/evolution/educators/teachstuds/svideos.html>
- Ultraviolet Light
- Germ Glow – <http://www.glogerm.com/>
- The Effectiveness of Antibacterial Soap Lab Handout (attached to Day 2 Lesson)



8 Additional Resources ----- None

9 Procedures & Methods ----- The lesson plan's course is as follows:

A. Introduction

Since the discovery of Penicillin and its medicinal uses by Alexander Fleming in 1928, Penicillin and other antibiotics have saved thousands of lives from several bacterial diseases. Although known to be ineffective on viruses, antibiotics kill or inhibit the growth of bacteria. Due to the bacteria's genetic mutation, misuse of antibiotics, or a combination of both, bacteria have been able to build immunity to several of the antibiotics over the past century.

The ability of bacteria to develop a resistance to an antibiotic allows bacteria to survive doses of antibiotics that would otherwise prove to be lethal. This is particularly true with Penicillin and Erythromycin. Drug resistance not only plays a vital role in the daily lives of the population, but also plays a significant part in terms of bio-terrorism in the event terrorists use some means to infect the population with bacteria such as Anthrax, Smallpox, and Botulism.

B. Development

Prior to the start of class, sprinkle Germ Glow on common contact areas such as door handles, pencil sharpener, etc. After the introduction, discuss with students the high probability of coming in contact with germs. Explain that certain areas with which many of them come in contact several times in a given day have a higher concentration of bacteria than others. Inform students about the ability of the ultraviolet (black) lights to detect “germs” and walk up and down the aisles with the ultraviolet (black) light, scanning the students’ hands. While engaging the students, the teacher should ask the following questions:

- What common areas harbor the highest concentration of bacteria?
- What common areas do you think you touched to become “infected”?
- What is the simplest way to prevent the spreading of the bacteria?

Activity should take approximately 15 minutes.



C. Independent Practice

Students will watch the video, “Why Does Evolution Matter Now”, a video focusing on the transmission of tuberculosis and the evolution of multiple drug-resistant strains of TB in a Russian prison. Students need to consider the following questions while watching the video:

- How does the misuse of antibiotics affect the evolution of disease-causing bacteria?
- Why is a resistant strain of TB in Russia a concern for citizens of the United States?
- In what other settings would you expect antibiotic resistance exist?
- Why does the prison setting provide a perfect environment for TB to replicate?

Students should be given approximately 15 minutes to complete this activity.

D. Practice

Students will get into groups of three to prepare agar plates of bacterial growth to test the effectiveness of soap and antibacterial hand sanitizer. Distribute lab handout to the groups of students and discuss the instructions for each team. Once, finished providing samples, put away Petri plates until lesson 2 in which bacterial growth will be analyzed.

Students should be given approximately 15 minutes to complete this activity.

E. Accommodations (Differentiated Instruction)

Students who have visual, mobile or hearing impairments may need adaptive computer software to assist with using the computer and accessing the websites for information, as well as viewing the video. Students who need extra scaffolding may need a graphic organizer to use information gathering session during the video. Gifted/High Ability students may wish to explore the issue of drug resistant bacteria through a self-selected in-depth investigation. Mathematics can be infused into the lesson by looking at death rates from bacterial diseases before and after the introduction of antibiotics

F. Checking for understanding

- Students will be asked to explain how bacteria evolve to gain the ability to be drug resistant.
- Students will be asked to discuss the relevance of drug resistance in relation to globalization and bio-terrorism



G. Closure

Careers Involved in Drug Resistance

- Center for Disease Control – http://www.cdc.gov/employment/menu_topjobs.html
- Physicians
- Pharmacists
- Public Health Advisors
- Epidemiologists
- Microbiologists

10 Evaluation

Students will be evaluated by their individual role in the discussion of the video and Germ Glow activity (See Day 2).

11 Teacher Reflection

To be completed by teacher following the lesson.

12 Resources & Media

- http://www.actionbioscience.org/evolution/lessons/meade_callahanlessons.pdf
- <http://www.immed.org/illness/bioterrorism.html>
- “Why Does Evolution Matter Now?” Video - <http://www.pbs.org/wgbh/evolution/educators/teachstuds/svideos.html>
- http://www.cdc.gov/employment/menu_topjobs.html
- Ultraviolet Light
- Germ Glow – <http://www.glogerm.com/>
- The Effectiveness of Antibacterial Soap Lab Handout (attached to Day 2 Lesson)

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